NASA Facts
National Aeronautics and
Space Administration

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WASTE MANAGEMENT

To anyone not closely connected with the manned space flight program, the most often wondered, yet difficult question to ask may be, "How do you go to the bathroom in space?"

The problem is not merely how to "go to the bathroom" in the weightlessness of space, but how to dispose of the wastes as well; neither is it limited to providing for urination and defecation, for the act of breathing creates potentially dangerous byproducts, and on long-duration missions even a man's beard may become an important factor.

Prior to the Skylab missions, the space available for waste functions was severely limited. As a result, the waste management systems were limited in design. Simplified, the system used for urination was a version of the time-honored "motorman's friend," so called because the hose-and-bag unit was worn by the streetcar motorman, whose job gave him little opportunity for a rest stop; the defecation device was a plastic bag which was stuck to the posterior during defecation and which collected the feces.

In space terminology, these functions are called "waste management," while removal of carbon dioxide and moisture from the air the crew has breathed comes under "environmental control." Shaving (or, more significantly, disposing of the whiskers so they do not get into delicate electronic or optical equipment, or even into the crew's lungs) probably belongs halfway between everyday "crew comfort" and common "housekeeping."

In the Skylab Workshop the habitable space and storage areas were not so restricted as they were on previous missions. Waste management systems could be used which were much more acceptable. In general, the feces and urine systems used air flow to collect and transport the waste products. Crew handling of wastes was minimized.

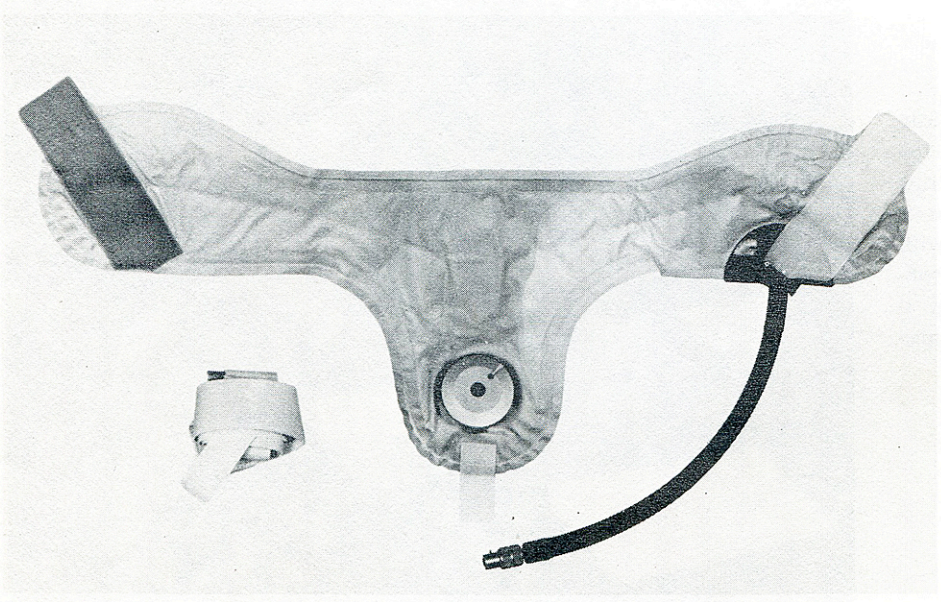
Future space missions will have systems similar to those used in Skylab. Improvements are being incorporated which will completely eliminate crew handling of the waste products.

The Space Shuttle will be equipped with unisex toilets that are similar in appearance to those in homes. The wastes will be vacuum dried, chemically treated and stored until return to Earth, when the storage containers will be emptied between flights. The Shuttle is a reusable space vehicle that is launched vertically into orbit atop a booster, but which lands back on Earth runways like an airliner.

Postflight laboratory analysis of waste specimens is important in determining how the human body reacts to space, so collection and storage equipment and procedures are required. The premium put on storage space, however, results in most of the liquid waste being emptied into space, where it vaporizes. Such overboard venting may produce enough thrust to change the spacecraft's attitude.

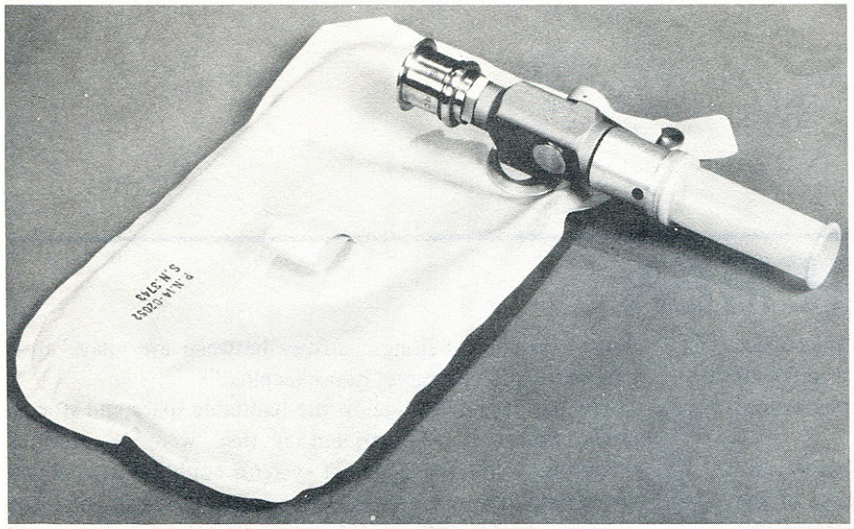
Obviously, waste management in spaceflight has been – and always will be – a subject for much thought and careful design.

Future long term spaceflight will require waste reclamation and reuse. Techniques already have been developed to extract water from urine, purify it, and filter it to make it drinkable. If the process works in space, it will mean the weight and storage penalties imposed in carrying potable water will be reduced.



URINE COLLECTION TRANSFER ASSEMBLY

Worn by astronauts during such occasions as liftoff and EVA, and in other pressure-suited activities.



URINE TRANSFER SYSTEM

The plastic-lined collection bag is used inflight. A one-way receiver valve prevents backflow, while a special fitting connects the device to an overboard dump hose.

SCRUBBING THE AIR

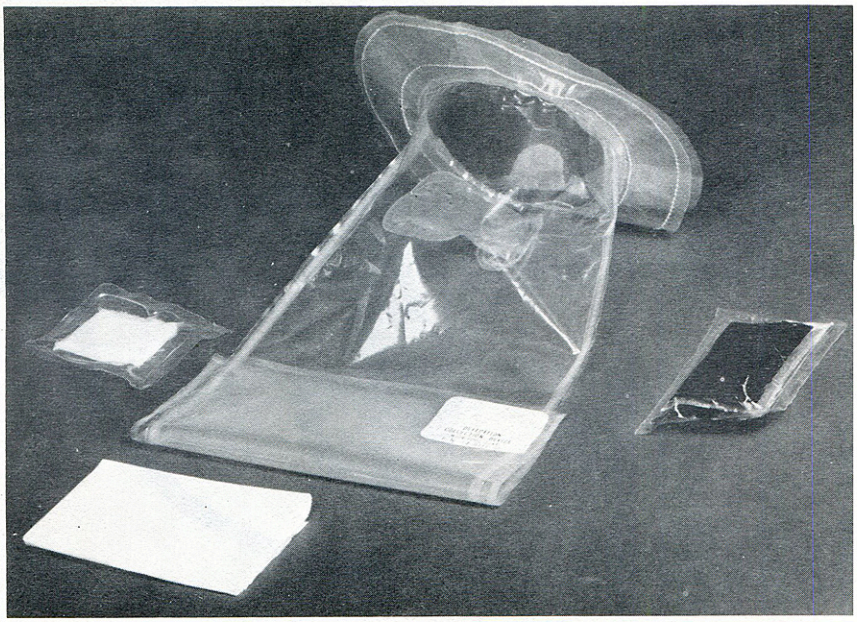
Other considerations of managing man's bodily by-products include the removal of carbon dioxide, moisture, and odor from the air he breathes. Current systems circulate the air through chemical filters – lithium hydroxide and activated charcoal, for instance – for gaseous purification, and spin the moisture out in a fan-like impeller.

Perspiration is a body waste that does not particularly lend itself to, or require, special management. It is, however, of medical interest as a factor in the dehydration experienced by astronauts on some flights. One method developed to analyze perspiration during orbital flight was to launder the crew's constant-wear undergarments in distilled water after the flight, then test the water for mineral and nitrogen content.

CORRALLING WHISKERS

Perhaps the most prosaic of the waste management problems was how to keep the whiskers cut off during shaving from floating about weightlessly, fouling up equipment or irritating the crew's eyes and lungs. As with some of the other waste management problems, this was nonexistent on the short-duration flights. But beard growth in missions of several days, then a week and longer, was uncomfortable. On one month or longer flights, the situation could be intolerable. An electric shaver incorporating a tiny vacuum cleaner that would suck up the whiskers as quickly as it lopped them off was considered.

Another approach favored a cream or gel depilatory to melt whiskers away, the residue mopped up with a towel. The solution came close to the latter thought: shaving cream and a safety razor. As obvious as that answer seems, however, its application depended a great deal on the experience gained in previous flights and the confidence that man could do many of the things in space as he was accustomed to doing them on Earth.



DEFECATION COLLECTION DEVICE

The plastic fecal bag contains an adhesive-coated rim which fastens the bag to the body. After use, a germicidal chemical is placed into the bag along with the used toilet tissue, and the adhesive-coated rim pressed together to form a liquid-tight seal.

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